UPS and Stand-by Supplies

INTRODUCTION

In recent months we at Delco Remy have received an ever-increasing number of inquiries concerning the use of our batteries in UPS (Uninterruptable Power Supplies) and other stand-by or emergency back-up power supplies. In response to their requests, we have recommended the Delco 1150 for almost every application. It is believed that with the help of this publication that these applications can be made by yourselves and thus increase the use of our batteries for this new and expanding market.

EXPERIENCE

Although the Delco 1150 was not primarily designed for UPS systems, it has been used in these systems since it was introduced. It offers the advantage of our maintenance-free battery and yet is able to withstand cycling. The battery is now used in many varied applications and should be applicable for many others.

At the present time, our batteries are being used in UPS and stand-by systems listed below:

1. Emergency starting for diesel generators at telephone company;
2. Emergency police radio communications;
3. Back-up for commercial radio transmitters;
4. Back-up for business computers;
5. Back-up for manufacturing processes that require continuous power for chemical mixing and/or computer controlled processes;
6. Navigational safety aids;
7. Emergency power for cable tv systems;
8. Emergency ventilation systems for chicken and hog buildings.

This list is by no means complete; however, it can give you an idea as to some potential uses for our battery in UPS and stand-by systems.

APPLICATIONS

From time to time it will become necessary to assist a customer in selecting the number of batteries for his UPS system. To assist in making the proper application use, the "Stationary Battery Application Data" sheets are attached. Using the data from this sheet and the following examples, system sizing will be much easier.

EXAMPLE #1 -- Office of Emergency Medical Service

System is for an emergency radio transmitter network. ~~located throughout the state~~. They are normally supplied with power from 110VAC lines thru a DC supply. However, there are frequent power outages and they require a 72-hour back-up. The temperature minimum is expected to be 0°C and a maximum of 30°C. When the system is in operation, it will transmit for 15 minutes each hour. The current drain during transmit is 25 amps and .5 amps during stand-by.

EXAMPLE #2 -- Ventilation System for Farm Buildings

System normally supplied by 110VAC lines thru a DC power supply. If the ventilation system for chicken barn were lost it could kill 10,000 chickens due to gas buildup in building. The system is 24VDC motor that pulls 20 amps. They require a 12 hour reserve back-up. The average temperature is 25°C with normal extreme between 10°C and 35°C.

BATTERY REQUIREMENT DETERMINATION

With the information in the two examples we can now size the system as follows. The necessary data may be taken off the Stationary Battery Application Data sheet; however, it is intended as a guide only, and may be modified to suit the individual sizing the system. As you will note, the battery capacity varies with discharge rate and the batteries' temperature (this is covered in the following examples). Also of importance is the freezing point of battery at end of discharge. As a general rule, it is best not to completely discharge the battery, i.e., the 70% D_T in the examples.

DT

This data sheet serves as a guide to estimate the number of batteries which should be used to provide required system voltage and energy storage capacity for a given application. As with any lead acid battery, you can quickly estimate the number required in parallel by dividing the total amp-hour capacity required by the rated battery capacity. This method does not take into consideration the affects temperature, discharge rate, state of charge, and cycling have on battery performance. Accordingly, the steps below are provided to allow for more accurate estimation.

STEP 1: How many batteries are required in series?

Nominal voltage rating = 12V

$$Bs = \frac{V}{12} \text{ (round off to next highest number)}$$

STEP 2: What is estimated number of batteries required in parallel?

$$***Bp = \left[\frac{100 \cdot L \cdot N}{Dr}\right] \div \left[C\right]$$

STEP 3: How many batteries in total are required?

Bt = Bp · Bs = ______________ batteries

Emergency Medical Radio System (Example #1)

System Voltage = V = 12V

Daily Load
Characteristics = .5A @ 18 hrs/day
25A @ 6 hrs/day

$\therefore L = (.5)(18) + (25)(6) = 159AH$

Days back up required = N = 3

Average Ambient = 20°C

Emergency Medical Radio System (continued)

Common
Temperature Extremes = 0°C to 30°C

V = 12
N = 3
C (0°C; est. 25 amp rate/battery) = 65AH
L = 159AH
DT = 70% since ambient extremes are only 0°C freezing point not a factor

STEP 1: $Bs = \frac{12}{12} = 1$ in series

STEP 2: $Bp = \left[\frac{100 \times 159 \times 3}{70}\right] \div (65) = 10{,}5 = 11$ in parallel

65

STEP 3: Bt = 1 x 11 = 11 batteries total

Emergency Ventilation System (Example #2)

System voltage = V = 24V

Daily Load
Characteristics = 20 amp @ 12 hrs/day

Days back-up required = 1

Average Ambient = 25°C

Common Temperature Extremes = 10°C to 35°C

V = 24
N = 1
L = ~~300AH~~ 240 AH.
DT = 70% (since ambient extremes greater than -10°C and battery will not be at 30% state of charge frequently or for long periods)
C = (25°C; est 5 amps rate per battery = 95AH)

STEP 1: $Bs = \frac{24}{12} = 2$ in series

STEP 2: $Bp = \left[\frac{100 \times 240 \times 1}{70}\right] \div (95) = 3.6 = 4$ in parallel

STEP 3: Bt = 2 x 4 = 8 batteries total

** Maximum 70% discharge depth recommended (i.e., minimum 30% end state of charge). This limit is established assuming the battery will not remain at this level for an extended period. For climates colder than -10°C this limit should be raised per Figure 2, reverse side.

*** This is an estimate only. During these unfavorable conditions, the avera[ge] state of charge should not go below 50% for both re-charging and freeze point considerations. In climates colder than -20°C this lower limit sho[uld] be raised per Figure 2, reverse side. ANY number of batteries may be us[ed] in parallel to achieve the desired capacity.

Key:

N = number of days energy storage required

C = rated battery capacity in amp-hours (Fig. #1)

L = total daily load in amp-hours

V = system voltage

***Bp= number of batteries required in parallel

Bs= number of batteries required in series

Bt= total number of batteries required

**Dt= desired percent of rated capacity removed from battery loss of power occurrence

Charging System Recommendations

Although the Maintenance Free battery line was developed and designed for vehicular applications, many batteries have found their way into non-vehicular applications. These applications range from starting batteries on stand-by power generating equipment, to back-up systems on UPS applications.

The one thing that many of these applications have in common is a continuous float charge applied to the batteries. In many systems, the float charge voltage is arbitrarily picked, and many batteries are overcharged, resulting in decreased battery life.

To maximize battery life in these systems, the charging of batteries must be done with care. Recommended charging procedures are:

1. The use of a system which "cycle charges" the batteries is preferred. In this system, the charger comes on at a voltage equal to 90% S.O.C. and is cut off at 100% S.O.C. (Example: the charger comes on when the OCV drops to 12.50 volts and charging at 5 amps, goes off at 13.50 volts)

2. On a continuous float charge, the voltage should be between 13.2 and 13.7 volts.

Charging System Recommendations (continued)

3. If #2 above is used, a charger having line voltage compensation must be used. If the line voltage increases by 10%, in some cases, the float voltage will also increase by 10%. In this case a 13.5 VDC per battery would increase to 14.85 VDC. This condition will result in an increase in the electrolyte usage and a decrease in battery life.

4. With either charging system, all batteries need to be inspected on a regular basis, and any batteries with yellow indicators removed.

Large System

A note on large systems. If necessary, any number of batteries may be paralleled. If a large number is to be used it is of prime importance that proper terminators be used. An improper or bad terminator can cause a voltage drop that will not allow proper recharge (i.e., equal recharge of all batteries). When operating with batteries in parallel, it is best to take the positive output from one end of the string and the negative from the other end of string. This will allow any voltage drops to cancel and improve recharge.

We also have had a number of higher voltage systems in operation. There are a couple of important notes on such operations:

1. It is best to boost all batteries in a parallel configuration prior to placing in a series string for approx. 24 hours. This will equalize all batteries and make up for differences due to age or storage conditions.

2. If there are to be a number of series-parallel batteries (i.e. more than one parallelsstring), it is best to parallel the batteries at each voltage level. This involves more wiring; however, it is the most reliable system.